Global Hydrology Resource Center

Data User Guide

GPM Ground Validation Precipitation Video Imager (PVI) LPVEx

Introduction

The GPM Ground Validation Precipitation Video Imager (PVI) LPVEx dataset consists of precipitation particle images and drop size distribution (DSD) data collected by the Precipitation Video Imager (PVI) during the Global Precipitation Measurement (GPM) mission Light Precipitation Validation Experiment (LPVEx) field campaign. This field campaign took place around the Gulf of Finland in September and October of 2010. The goal of the campaign was to provide additional high-latitude, light rainfall measurements for the improvement of GPM satellite precipitation algorithms. The PVI instrument was designed by Dr. Larry Bliven at NASA Wallops Flight Facility. Data files are available from September 17, 2010 through May 11, 2011 in Excel format and contain the average, minimum, and logarithmic DSD bin sizes and number of particles per unit time. Browse images are available in BMP and JPG formats.

Notice:
While the LPVEx campaign officially took place in September and October 2010 in the Gulf of Finland, PVI instruments were operational after the campaign with data extending to May 11, 2011.

Citation

Wolff, David and Larry Bliven. 2019. GPM Ground Validation Precipitation Video Imager (PVI) LPVEx [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/GPMGV/LPVEX/PVI/DATA101

Keywords:

NASA, GHRC, GPM GV, LPVEx, PVI, precipitation, drop size distribution

Campaign

The Global Precipitation Measurement mission Ground Validation (GPM GV) campaign used a variety of methods to validate GPM satellite constellation measurements prior to and after the launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint agency/international external field campaigns, using state of the art cloud and precipitation observation infrastructure (polarimetric radars, profilers, rain gauges, and disdrometers). These field campaigns accounted for the majority of the effort and resources expended by the GPM GV mission. More information about the GPM mission is available on the PMM Ground Validation webpage.

The Light Precipitation Validation Experiment (LPVEx) sought to characterize high-latitude, light precipitation systems by evaluating their microphysical properties and utilizing remote sensing observations and models. This campaign was a collaborative effort between the CloudSat mission, GPM GV mission, the Finnish Meteorological Institute, Environment Canada, the United Kingdom National Environmental Research Council, Vaisala Inc., and the University of Helsinki. The campaign took place in September and October of 2010 in Northern Europe in the areas surrounding the Gulf of Finland (Figure 1). One of the objectives of the experiment was to evaluate the performance of satellite measurements when estimating rainfall intensity in high-latitude regions. This data collection had the purpose of improving high-latitude rainfall estimation algorithms and understanding of light rainfall processes. The campaign utilized coordinated aircraft flights, atmospheric profile soundings, ground precipitation gauges, radar measurements, and coordinated satellite observations to obtain light precipitation properties and the spatial distribution of those properties. More information about the GPM LPVEx campaign can be found on the LPVEx Field Campaign webpage.

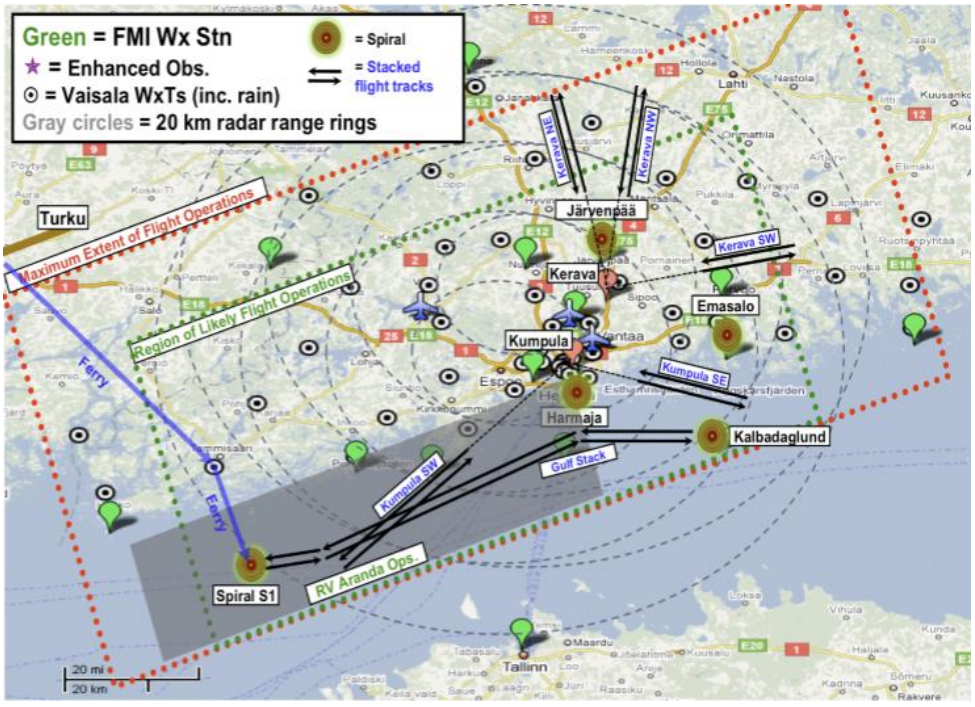

Figure 1: LPVEx field campaign study area along the Gulf of Finland
(Image source: LPVEx Science Plan)

Instrument Description

The PVI instrument (sometimes called the Snowflake Video Imager (SVI)) was designed by Dr. Larry Bliven at NASA Wallops Flight Facility (WFF). It is an automated sampling system which records greyscale images at a high frame rate, enabling the particle size in rain and snow to be determined. The instrument measures snowflake size distribution and snowflake orientation distribution; the nominal pixel size of an image is 0.05 mm by 0.1 mm.

The field of view is 32x24 mm at the focal plane, and the depth of field is approximately 117 times the particle equivalent diameter. PVIs operate at a nominal 60 frames per second (fps), 24/7; some data gaps do occur during power outages, periods of clear weather when acquisition was halted for processing of quick look data products, data backups, and system alignments. A more detailed description of PVI/SVI is documented in Newman et al. (2009).

Investigators

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Data Characteristics

The GPM Ground Validation Precipitation Video Imager (PVI) LPVEx dataset includes precipitation particle images and drop size distribution data from September 17, 2010 through May 11, 2011. This dataset is available at Level 1A and Level 2 processing levels. More information about the NASA data processing levels are available on the EOSDIS Data Processing Levels webpage. Table 1 shows the characteristics of this dataset.

Table 1: Data Characteristics

Characteristic	Description
Platform	Ground Stations
Instrument	Precipitation Video Imager (PVI)
Spatial Coverage	N: 40.01 , S: 39.99, E: 105.01, W: 104.99 (Gulf of Finland)
Spatial Resolution	0.05 mm by 0.1 mm
Temporal Coverage	September 17, 2010 - May 11, 2011

Temporal Resolution	Level 1: hourly; Level 2: daily
Sampling Frequency	60 fps
Parameter	Precipitation, drop size distribution
Version	1
Processing Level	Level 1A, Level 2

File Naming Convention

The PVI LPVEx dataset files are named using the following convention:

Data files: lpvex_pvi_YYYYMMDD_hhmm.ici
lpvex_pvi_DSD_YYYYMMDD.xls
Browse files: lpvex_pvi_YYYYMMDD_hhmm_###.bmp
lpvex_pvi_YYYYMMDD_snow_[D|L|W]_[lin|log]_A.jpg
lpvex_pvi_YYYYMMDD_snow_[D|L|W]_[lin|log]_I.bmp

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
###	PVI instrument number (i.e., 001, 002, ……)
D|L|W	Drop size distributions (DSDs) are presented as: D = equivalent diameter L = longest axis W = max horizontal axis
lin|log	lin = linear-bin format log = log-bin format
A|I	Types of browse images: A = scatter plot (DSDs versus D, L, or W) I = time series of D, L or W
.ici	Binary file format
.xls	Excel format
.bmp	Bitmap image format
.jpg	JPEG image format

Data Format and Parameters

The GPM Ground Validation Precipitation Video Imager (PVI) LPVEx dataset contains Level 1A binary files in ICI format and Level 2 data files in Excel format. Each Level 2 Excel data file contains 8 spreadsheets (Table 3).

Table 3: Spreadsheets in Excel data file.

Spreadsheet Name	Description	Sheet Row(s) and Column(s)
Header	Overview of the data contained within the Excel file	-
DSD_min_D_lin DSD_min_L_lin DSD_min_W_log	DSD minute data presented as: D_lin = equivalent diameter with linear-bin format; L_lin = longest axis with linear-bin format; and W_log = max horizontal axis with log-bin format	Row(1): Drop size bin left edge (mm) Row(2): Bin size (mm) Row(3): Bin center (mm) Row(4,5,.....): DSD ($m^{-3}mm^{-1}$) Col(A): Time (UTC)
DSD_avg_D_lin DSD_avg_L_lin DSD_avg_W_log	DSD average data presented as: D_lin = equivalent diameter with linear-bin format; L_lin = longest axis with linear-bin format; and W_log = max horizontal axis with log-bin format	Row(1): Drop size bin left edge (mm) Row(2): Bin size (mm) Row(3): Bin center (mm) Row(4): DSD average ($m^{-3}mm^{-1}$)
N_Data	Number of precipitation particles	Col(A): Time (UTC) Col(B): particles per minute

Algorithm

PVI images are predominantly white, with an occasional gray shadowgram of a snowflake. The detection software finds snowflakes in PVI images in the compressed data files and outputs a record of basic information for each snowflake into a summary file. The PVI detection algorithm is concisely summarized in Newman et al. (2009).

Quality Assessment

The PVI calibration procedure uses a ruler in the focal plane and adjustment of the lens. The calibration is straightforward and the images are acceptable for the intended applications (Newman et al., 2009).

Software

No special software is required to view the PVI LPVEx dataset files. The Excel files can be viewed in a spreadsheet software such as Microsoft Excel.

Known Issues or Missing Data

PVIs operate at a nominal 60 frames per second (fps), 24/7; some data gaps do occur during power outages, periods of clear weather when acquisition was halted for processing of quick look data products, data backups, and system alignments.

References

Newman, A. J., P. A. Kucera, and L. F. Bliven (2009). Presenting the Snowflake Video Imager (SVI). *Journal of Atmospheric and Oceanic Technology*, 26, 167–179. doi: https://doi.org/10.1175/2008JTECHA1148.1.

Related Data

All data collected by other instruments during the LPVEx field campaign are considered related datasets. These data can be located by searching the term 'LPVEX' using the GHRC HyDRO2.0 search tool.

Additionally, the PVI instrument has been used in the GPM Ground Validation Cold-season Precipitation Experiment (GCPEx) (http://dx.doi.org/10.5067/GPMGV/GCPEX/PVI/DATA301)

Contact Information

To order these data or for further information, please contact:

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